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PUBLIC WORKS.

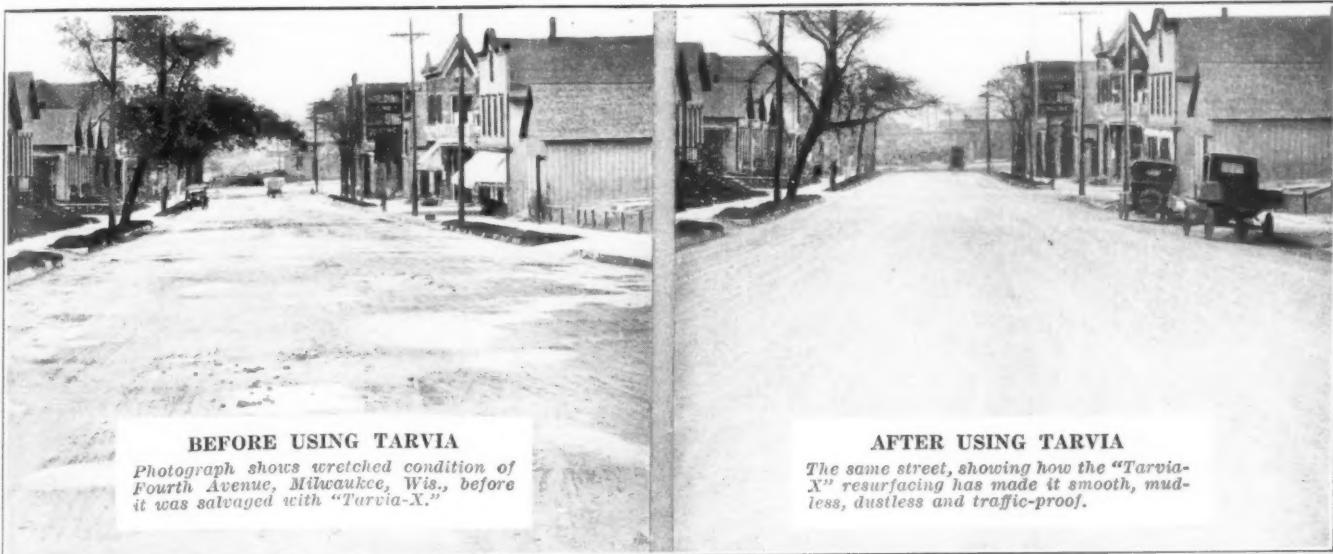
CITY

COUNTY

STATE

A COMBINATION OF

"MUNICIPAL JOURNAL & PUBLIC WORKS" and "CONTRACTING"



BEFORE USING TARVIA

Photograph shows wretched condition of Fourth Avenue, Milwaukee, Wis., before it was salvaged with "Tarvia-X."

AFTER USING TARVIA

The same street, showing how the "Tarvia-X" resurfacing has made it smooth, mudless, dustless and traffic-proof.

To Get Good Roads—Cheaply—Quickly— Save the Roads You Have!

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Many progressive communities recognize this fact, and are carrying out an extended road salvage program, rather than build new roads at present exorbitant prices.

For example, the City of Milwaukee has in this way transformed 1,700,000 square yards of water-bound macadam into splendid modern streets to the complete satisfaction of both the city authorities and the traveling public.

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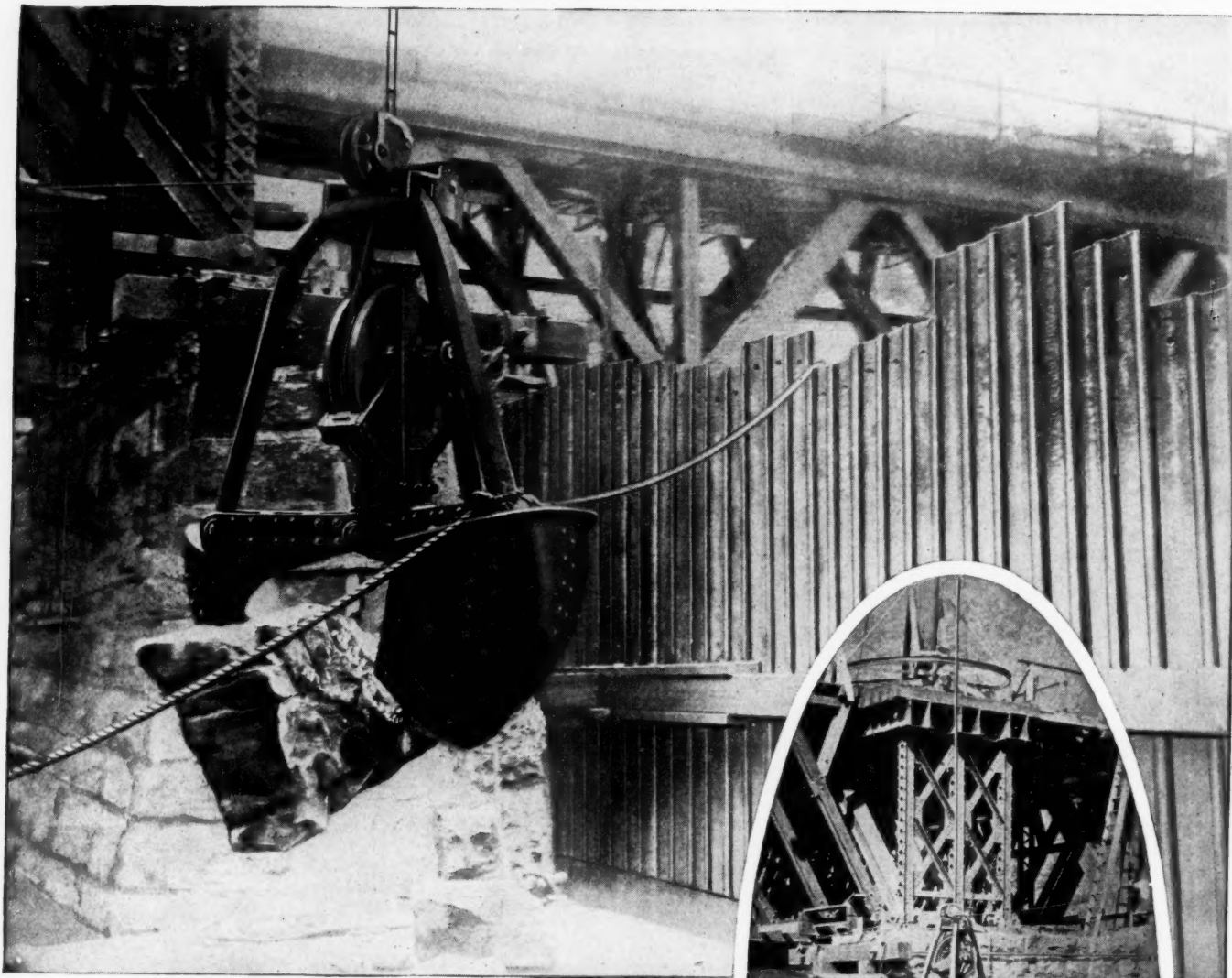
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NEW YORK, JUNE 5, 1920

PUBLIC WORKS

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There are available, however, other types of Hayward Three-sided and Standard Orange Peel Buckets, as well as Clam Shell Buckets, which are used by contractors for the economical handling and digging of all materials—from mud to blasted rock and hard pan.



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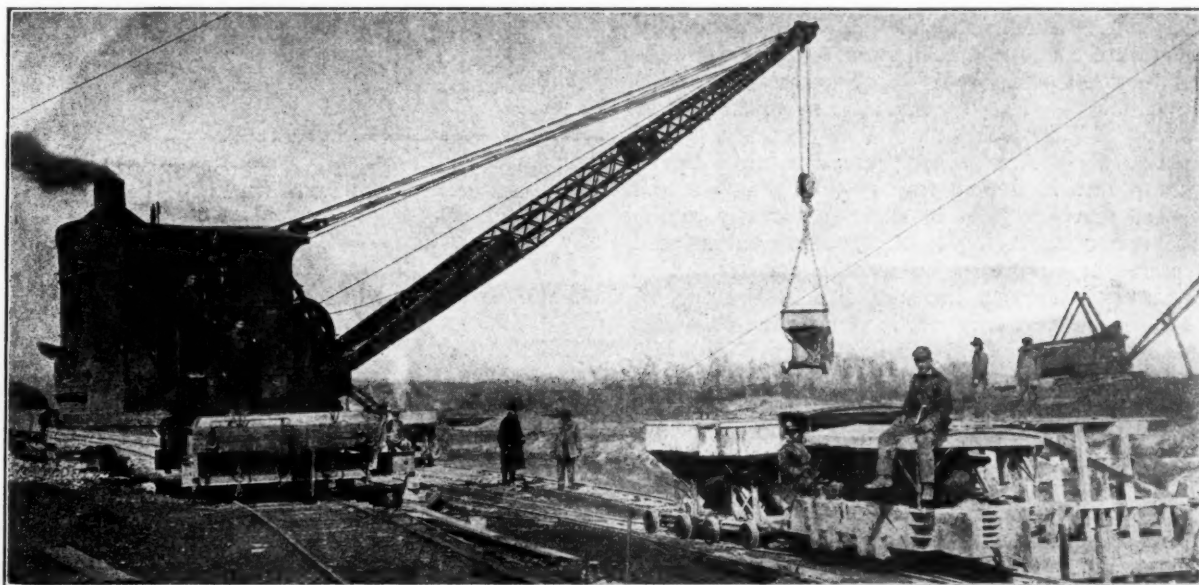
STATE

A Combination of "MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"

Vol. 48

NEW YORK, JUNE 5, 1920

No. 21



SHIFTING DUMP CAR FILLED WITH CONCRETE TO HIGHER LEVEL, WHENCE CAR CAN DELIVER DIRECTLY BY GRAVITY TO FORMS.

Concrete for Miami Conservancy District Work

Excavating, preparing, grading and storing aggregate. Testing and proportioning materials. Mixing and delivering concrete. Experimental determination of most desirable mixture of sand, gravel and mortar, with tables of voids and density for different sizes of aggregates.

The construction of the five dams for flood control in the Miami Conservancy District involves the use of about 200,000 yards of concrete in the controlling works, which are principally massive structures for tunnels, conduits, spillways, weirs, sidewalls and floors.

As the building of these structures governed to some extent the progress and sequence of other operations, and as they were very large and important elements of each dam, the design and installation of the plants for executing them were of considerable engineering and economic import-

ance. Careful studies were made for the development of substantially uniform practice and standard methods and equipment for the different dams, which varied only as necessary for local conditions and special requirements. Rapidity, reliability and efficiency of operations, simple and economical construction, and a large and constant output at a reasonable cost and with simple methods and apparatus, were the desiderata, which were largely attained by the use of standard equipment carefully combined and arranged.

Hand labor was avoided as much as practicable,

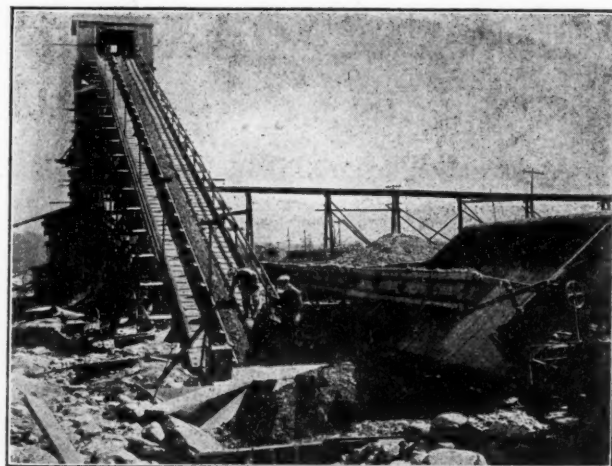
gravity methods were used where available, and the operations were made to a large extent simple and continuous. The duration of the work for several years justified the installation of sufficient high-class equipment, some of which will have a salvage value at the end of the work and all of which can be maintained and renewed to the best advantage, while the cost of the items that afford no salvage is distributed over so much time and so large a quantity of work that it becomes an insignificant factor of unit cost.

GENERAL FEATURES.

Sand and gravel are derived from the necessary excavations or from borrow pits and are usually secured by the operation of large dragline excavating machines working on dry land or under water, according to local conditions. The sand and gravel are loaded by the excavating machine into 12-yard air dump cars hauled in trains by locomotives and deposited in stock piles or dumped directly into a track hopper delivering to the foot of an inclined belt conveyor supported on wooden trestles. This belt conveyor carries the material to the top of the concrete tower, where it is run through a series of assorting and washing screens which separate the large stones, coarse gravel, fine gravel and sand. All except the rejects are deposited in separate bins having chutes through which the contents are delivered by gravity to adjustable measuring boxes, through which they pass to the charging hopper of a 1-yard Smith tilting mixer installed in the center of the lower part of the tower, directly under the sand bin.

The mixer is at an elevation high enough to permit the mixed concrete to be discharged directly from the machine to conveying chutes or, when these are not available, the machine discharges into 1¼-yard steel concrete cars hauled by a 3-ton Plymouth gasoline locomotive on a 36-inch gage service track. When the cars cannot dump directly into the forms, they are lifted bodily from the track to a higher elevation by locomotive cranes. In some cases the mixer discharges through a short trough to a bucket in the top of a wooden hoisting tower, where it is emptied into a receiving hopper which feeds a line of suspended chutes conveying it to the forms, or to distributing hoppers, whence it is wheeled to the required position.

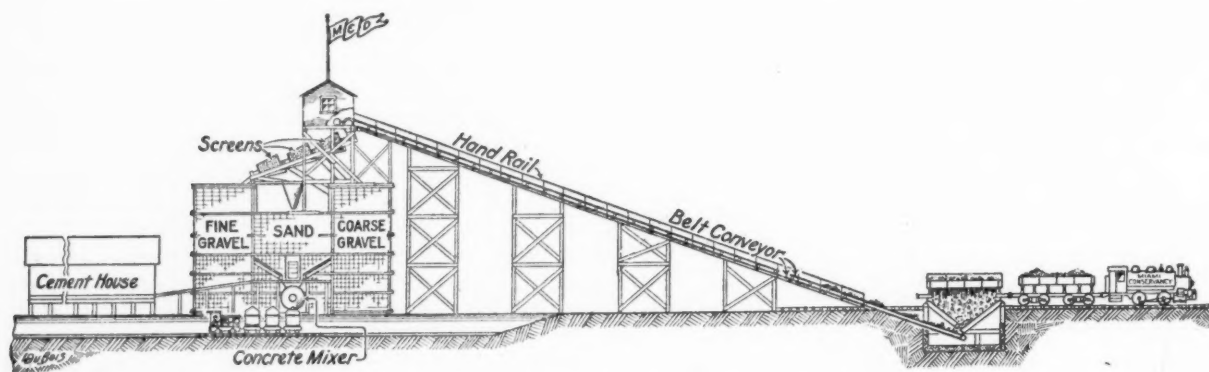
At the Taylorville dam, the 55,000 yards of concrete required is more than the amount mixed at



DUMPING GRAVEL TO HOPPER OF ELEVATOR AT SCREENING AND WASHING PLANT.

any of the other dams. In some cases the mixer discharges directly into bottom-dump steel buckets on flat cars hauled to position by locomotives. At the Lockington dam, the controlling works containing about 38,000 yards of concrete have massive conduit walls, 82 feet high and 500 feet long, built with concrete delivered in buckets drawn by Fate gasoline locomotives and handled to the forms by steel derricks with booms 105 feet long. The plant here, like the others, has a capacity of 300 yards in one 10-hour shift. The total length of the mixing, screening, washing and storage plant is 675 feet and its height is 64 feet. The cement house is 100 feet long, the gravel washer and hopper is 215 feet long and the 20-inch belt conveyor is 360 feet long.

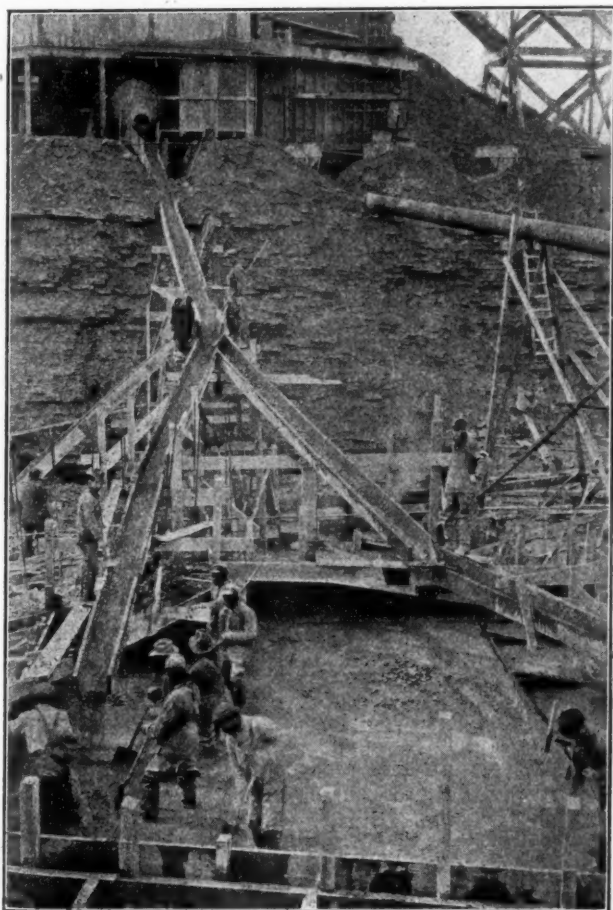
Three conical screens of perforated steel plates are mounted on shafts inclined about 15 degrees from the vertical, and the sand and gravel are delivered to the large upper end of the highest screen. The materials are thoroughly wet with water jetted into the lower ends of the screens and the revolution of the screens separates the materials into coarse gravel from 1½ to 3 inches in diameter, fine gravel from ¼ inch to 1½ inch, and sand less than ¼ inch in diameter, all of which flow from their respective screens through chutes to three large storage bins, the oversize material (from 3 to 6 inches in diameter) being rejected by the screens. In the deposits used for the concrete aggregate the



STANDARD SAND AND GRAVEL WASHING AND SCREENING AND CONCRETE MIXING PLANT.

amount of fine gravel generally exceeds that of coarse gravel by an average of about 50 per cent, although the proportion varies considerably and occasionally pockets of fine or coarse material are encountered as the stratum changes.

Occasionally there are found pockets with an excess of buckshot sand or pebbles, where the larger grains preponderate and make an unsatisfactory concrete mixture. When the excess is not too great, the extra amount of buckshot or pebbles is



CHUTING CONCRETE DIRECTLY TO POSITION
FROM ELEVATED MIXER.

removed by diminishing the force of the washing water in the lower screen and thus permitting the gravel to slide down the revolving screen while the sand drops through the holes. The longitudinal motion of the sand being thus accelerated, not so many of the particles pass through the holes. The buckshot thus enters the fine-gravel bin over an inclined screen which delivers it into a car on the gravel track, while the larger particles go to the measuring box. When the waste by this method is too great, excavation is shifted to another part of the sand and gravel pit where the proportion of fine and coarse material is more satisfactory. This change is made more easily because the unsatisfactory material usually is found in the lower strata, so that shifting to a higher stratum is effective.

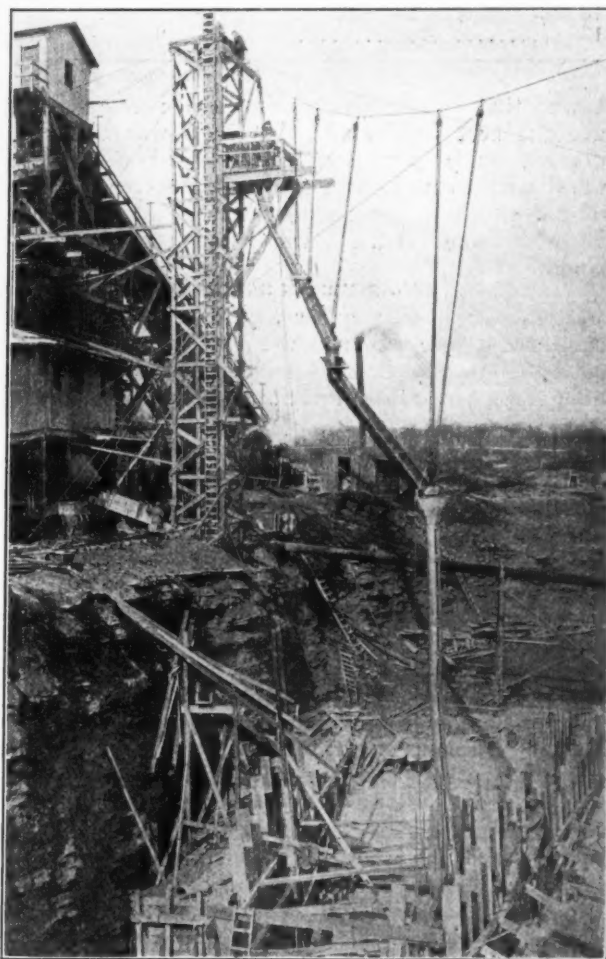
ELIMINATING VOIDS IN AGGREGATE.

In order to determine the best proportions of

fine and coarse gravel, sand, and cement, a special investigation was made of the materials used at the Taylorville dam, where 55,000 yards of concrete were required. Tests and investigations made by assistant engineer H. R. Daubenspeck formed the subject of an article published in the March issue of the Conservancy Bulletin, from which the information here presented was secured.

The relative proportion of fine and coarse gravel required to secure the minimum amount of voids and the maximum density of the concrete was determined by mixing carefully measured amounts of fine and coarse gravel in the regular concrete mixing machine. The measuring boxes used for charging the regular run of concrete to the mixer were calibrated so as to determine the exact quantity of materials in each charge, and after they had been mixed, they were dumped in a 51x52-inch rectangular box 24 inches deep, the upper surface of the contents leveled and its height accurately determined by measuring down to it from a straightedge across the top of the box. The volume of mixed aggregate having been thus calculated, the voids were determined by filling a vessel of $2\frac{1}{2}$ cubic feet capacity with the mixture and then adding to it all the water that it would hold, poured from a 10-quart measure marked to gauge fractional proportions.

A set of 4 experiments, recorded in Table I,



SPOUTING CONCRETE FROM HOISTING TOWER
TO FORMS.

Table I, voids and densities of mixtures having different proportions of large and small gravel.

Test No.	Coarse Gravel 1½" to 3"		Small Gravel 1¼" to 1½"		Total Volume		Ratio of mix to original volume (%)	% of voids in mix
	cu. ft.	% of mix	cu. ft.	% of mix	Before mixing cu. ft.	After mixing cu. ft.		
1	16	50.0	16	50.0	32	25.8	80.6	34.8
2	14	46.7	16	53.3	30	25.0	83.3	36.7
3	12	40.0	18	60.0	30	25.8	86.0	36.7
4	10	35.7	18	64.3	28	25.0	89.3	36.7

Table II, effect of proportion and moisture of sand on volume of aggregate.

No. of Test	Coarse Gravel.	Fine Gravel.	Sand.	Volume Mixed.	Remarks
	cu. ft.	cu. ft.	cu. ft.	cu. ft.	
5	16	16	14	34.4	
6	16	16	13	36.7	
8	12	18	13	33.6	Sand Damp
9	16	16	10	32.1	Sand More Damp
10	16	16	13	30.5	Sand Saturated

Table III, size of sand determined by sifting.

Screen No.	6	10	20	35	65
Diameter of wire.....	.036	.035	.0172	.0122	.0072
Size of opening.....	.131	.065	.0328	.0164	.0082
Test No.	Percentages of total amount of material that passed through screens.				
1	90%	78%	63%	22%	2%
2	85	72	66	23	3
3	81	67	56	23	2
4	74	58	34	10	3
5	68	50	31	7	1
6	55	26	14	7	2
7	59	36	20	8	2
8	67	42	21	3	1
9	73	48	27	5	1
10	71	41	15	7.5	1
11	71	40	22	5	1
12	75	49	33	10	1
13	77	58	28	12	1

showed that equal parts of fine and coarse gravel gave the best results and this ratio was therefor adopted, since increasing the amount of coarse gravel would cause extra labor, and decreasing the amount of small gravel would involve a loss, either of which would exceed the possible economy in cement.

MOISTURE IN SAND.

It was found that either dry or wet sand packs much more closely than moist sand, the latter having a volume 25 per cent greater than that of the same after complete saturation. In order to attain uniform results, it was only necessary to use saturated sand. Table II shows the effects on the volume of the mix that are caused by the varying amount of moisture in the sand with the standard mix of equal parts of fine and coarse gravel.

Tests 5 and 6 were made with sand taken at random from the bins, and for tests 8, 9 and 10, the amount of moisture in the sand was controlled, although not measured. The size of the sand was such that from 55 to 90 per cent would pass through a screen with an 0.131 opening and from 97 to 99 per cent of it would be rejected by a screen with an 0.0082 opening as indicated by the record of Table III, made with a Universal Sand Tester. These results demonstrated a great variation in the character of the sand, about 13 cubic feet of which were required with the 1:1 proportions of fine and coarse gravel that contained about 9 cubic feet of voids for one batch, and required 4 cubic feet of cement, making a mixture proportion 1:3.25:6.4, mixed with enough water to give the consistency of medium stiff porridge.

The saturation of the sand by giving it as much water as it would hold by capillarity before charging it into the mixer was found decidedly advantageous, insuring uniformity in the charge of sand and aiding the speed and smoothness of the mix. The gravel aggregate was wet with a hose before charging and a measured amount of water was run into the measuring box with each charge of sand. The final adjustment of water in the mix was made by jetting it into the mixer through a nozzle until the desired consistency, as determined by the eye, was reached. The amount of concrete, measured in the forms, averaged about 1.2 yards per batch for the 1-yard mixer.

The work was done under the direction of Arthur E. Morgan, chief engineer, and Charles H. Paul, assistant engineer.

Nile Flood Control Works

Works are contemplated for obtaining such complete control of the waters of the upper Nile as will enable Egypt to develop its agricultural resources to the utmost, secure the country against excessive floods and permit some development of the Sudan's resources. The work will extend over a generation and cost tens of millions of dollars. It will be in charge of a commission consisting of an irrigation engineer, nominated by the government of India, as president; a British physicist, nominated by the University of Cambridge, and an irrigation engineer, nominated by the government of the United States.

Traffic on Iowa Highways

Results obtained by taking actual weights of many thousand vehicles at seven points throughout the state show high tonnage, in which passenger automobiles overwhelmingly predominate, ninety per cent is motor-driven and inter-state traffic is insignificant.

With the above title, a pamphlet has been issued by the Engineering Experiment Station of Iowa State College of Agriculture and the Mechanical Arts, the author being T. R. Agg, highway engineer on the station staff. The information it presents was obtained by means of an investigation of the vehicles using Iowa highways.

It was believed that "any satisfactory method of comparing the economy of various types of road surface should take into account the weight of the traffic as one of the factors in the comparison." It did not seem necessary or practicable to weigh all the traffic on all the highways under consideration, but rather to establish adequate categories of weights for the various classes of vehicles and use these in taking future traffic census records.

Traffic weighings were made at seven stations, selected with regard to possible variation in the weight of vehicles in different parts of the state.

All vehicles were arbitrarily divided into the classes: one-horse passenger, one-horse freight, two-horse passenger, two-horse freight, roadsters, touring cars, motor trucks, motorcycles, tractors, bicycles. When the data were finally assembled, however, it was found unnecessary to consider so many classes, since the weights of certain classes overlap to such an extent as to eliminate any real line of demarcation between them. The weights of various classes of horse-drawn passenger vehicles, such as the one-horse and two-horse, overlap to such an extent as to make it undesirable and unnecessary to separate them in computing the weight factor. In the same way, the weights of touring cars and roadsters overlap to such an extent that it is more advantageous to include all passenger automobiles in a single class. The volume of miscellaneous traffic—tractors, riding horses, motorcycles and bicycles—was so small that this class of vehicles was disregarded entirely.

Finally the investigators adopted four groups as representing real differences in class weights, these being horse-drawn passenger vehicles, horse-drawn freight vehicles, passenger automobiles and motor trucks.

At each weighing station, each vehicle passing the station was weighed regardless of how many times that particular vehicle might pass. The weighing was continued for a period of ten days at each station. The method, type of scales used, etc., at these stations were described in *Municipal Journal* of September 13, 1917. Each driver was asked where he started from and where he was going, and the vehicle was classified thereby in the proper group. It was found possible to handle up to 200 vehicles an hour at a single station without appreciably delaying any of them.

In order to facilitate recording the data, a separate printed slip was used for each vehicle and

the desired information merely checked thereon. Each slip contained the names of the several types of vehicle, various tire widths differing by half inches, whether hard rubber or steel, etc. There were also other items for checking, such as chains, empty, grain, coal, wood, produce, in, out, farm traffic, interurban, inter-state, rain, wind, mud, etc.

The mean weights found at the seven stations for passenger automobiles were: 2,585, 2,520, 2,562, 2,657, 2,801, 2,799, 2,911. The mean weight for all stations was 2,713 and the average weight 2,691. For horse-drawn passenger vehicles the weights vary between 595 and 720, with an average of 671. Horse-drawn freight vehicles varied from 1,780 to 2,282, with the average of 1,998. Motor trucks varied from 2,476 to 5,406, averaging 3,720.

The weight per inch of bearing width of tire was calculated for each vehicle. By far the largest number carried between 150 and 250 pounds per inch width. Dividing the weights into classes varying by 50 pounds, and totaling all stations, it was found that 8,123 vehicles carried a weight of 150 to 200 pounds per inch width, 4,349 vehicles carried 200 to 250 pounds, 1,614 vehicles carried 100 to 150 pounds and 1,005 vehicles carried from 250 to 300 pounds. There was then a pronounced drop, the next highest number being 238 vehicles which carried from 50 to 100 pounds, followed by 147 vehicles carrying from 300 to 350 pounds, and 102 vehicles carrying from 350 to 400 pounds; 79 vehicles carried less than 50 pounds and three vehicles carried between 1,050 and 1,450 pounds. Between 400 pounds and 1,100 pounds, the number gradually diminished from 96 to 3.

A study of the various records and averages indicated that a computation of the total tonnage passing over a road, based upon the average weight, would be in error less than 10 per cent (assuming the traffic accounts to be accurate); except that in the case of motor truck traffic there is much wider variation and the error may be considerably greater than 10 per cent. It was believed impracticable to make a traffic count that is exact, but by a proper distribution of counting days to compensate for seasonal and irregular variation, the total annual volume of traffic may be closely approximated.

As the condition of the highways becomes more favorable for the operation of motor trucks and heavy horse-drawn vehicles, the average weight of these classes of vehicles may be expected to increase, and the maximum also to increase unless limited by legislation.

The weight per inch of bearing width of tire for present traffic does not appear to have any direct bearing on design and, if motor truck trailers with steel tires are prohibited, it is not likely that it will become a factor requiring to be considered.

As a result of a large number of measurements

of diameter of tire and width of track, it was found that the bearing width of pneumatic tires is very nearly equal to the diameter or "size" of the casing.

The counting was carried on from 7 a. m. to 9 p. m. each day. In a few instances the counting was continued for 24 hours and the data thus obtained, supplemented by special observations, indicate that the traffic actually counted represented 85 per cent of the total traffic for the days of the counting period.

CONCLUSIONS.

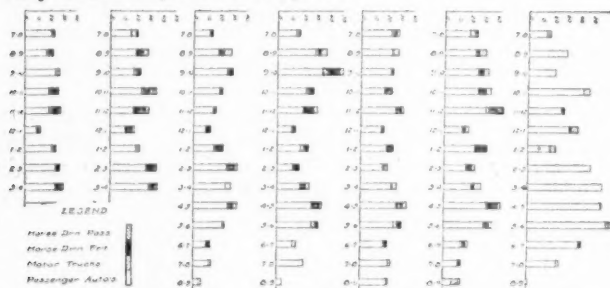
From a study of the census records it was gathered that the tonnage of traffic on Iowa highways is considerably larger than has been generally supposed. "In this state a system of earth roads has been carrying a traffic that would be considered moderately heavy for a paved road."

Passenger automobiles overwhelmingly predominate at present. The present highways, because of the extreme variations in the condition of the surface, do not encourage the use of motor trucks. The development of truck hauling, particularly for farm products, apparently has been held in abeyance pending the construction of suitable road surfaces.

The insignificant amount of interstate traffic at all of the stations, except near the state line, ought to set at rest the idea that highways are being constructed primarily for the use of tourists. The very considerable amount of interurban traffic is an indication of the extent to which the motor car is utilized for travel by town people.

About 90 per cent of the tonnage of traffic on Iowa highways is motor-driven, which emphasizes the equity of requiring a substantial contribution from owners of motor vehicles toward the construction and maintenance of public highways.

The pamphlet gives the estimated annual tonnage of the various kinds of vehicles in each of the counties of the state. The annual tonnage on the highways of the several counties was estimated to vary from 11,379 to 579,539.



TOTAL NUMBER OF VEHICLES PASSING PER HOUR FOR EACH OF SEVEN DAYS AT STATION 108.

That there was considerable hourly variation in the number of teams, and that this variation differs on different days, is illustrated by diagrams presented with the report, one of which is reproduced herewith.

The Western North Carolina Weekly Press Association at a recent meeting endorsed the program for a system of hard-surface roads in that state. They called upon the Governor and Assembly to provide the ways and means for their construction and urged that the funds be distributed impartially to the several counties of North Carolina.

Baltimore County Highway Work

Work last year on nine hundred miles cost nearly half a million dollars. Considerable machinery was used. Most of the work was of the nature of maintenance.

During the year 1919 Baltimore County, Md., spent \$492,417 on its roads, work having been done on 902.4 miles of highways. In the annual report of William G. Sutro, Baltimore county roads engineer, the expenditures are given in condensed form for the entire county, and in addition, a more detailed statement is given for each district. From this report the following items of information are gleaned:

The total expenditure by all of the counties for labor was \$81,261, while for material there was spent \$383,361, and \$27,795 miscellaneous expenditures. These figures indicate that only about 1/6 of the total expenditures was for labor. This, we believe, is a somewhat unusual ratio. Part, at least, of the explanation for it may be found in the amount of road machinery owned by the county. This machinery included 16 road rollers, three crushers, 5 tractors, 6 concrete mixers, 17 road scrapers, 2 scarifiers, 12 water sprinklers, 17 tar kettles, 12 gas pumps and 1 hand pump, 8 motor trucks and one touring car.

Of the rollers, 3 are Monarchs, 4 Buffalo-Pitts, 6 are Kelley, 1 Giser and 1 Russell. The 16th is a gasoline roller, make not given. Of the crushers, 2 are Holland and 1 Climax. Of the tractors, 3 are Fordson, 1 International and 1 Huber. The concrete mixers are all of 5 cubic feet capacity, make not given. Of the road scrapers, 2 are Climax, the names of the others are not given. Of the motor trucks, 2 are International, 2 are Autocar oilers, one is a Nash Quad, 2 are service trucks, make not given, and the touring car is a Chevrolet.

Most of the work was in the nature of ordinary maintenance. The report of District No. 1 may be considered as fairly typical of all the others. In this district approximately 50 miles of ditches were opened and a number of wooden bridges repaired and put in safe condition for travel. Four wooden bridges were replaced by reinforced concrete. Approximately 10 miles of road was resurfaced. A number of roads and avenues were given surface treatment of oil and gravel. One wooden bridge was replaced by a 36-foot corrugated iron pipe. Altogether, 170 feet of corrugated iron was used in the district for culverts. In patching pot-holes there was used 5,036 gallons of patch material.

The replacing of wooden culverts and small bridges with corrugated iron pipe appears to have been quite general, only 2 of the 15 districts failing to report the use of more or less of such pipe for this purpose. Several of them also report the

construction of concrete bridges to replace old wooden ones. Altogether, 35 concrete bridges were built in the county last year at a total cost of \$21,690; these including a considerable proportion of small spans which would be classed as culverts. This brings the total number of such bridges and culverts in the county up to 553.

Highway Work in Giles County, Tenn.

Information furnished us by the resident engineer for Giles County of the Tennessee State Highway Department indicates that there are certain features connected with highway work in some of the older states that fortunately are not found in most of the newer ones. For instance, old toll roads continue in service in this county; 16 miles of such roads were bought by the county last year

but about 29 more of these privately owned roads remain.

Another relic of older methods is the working out of taxes. The county included in its report of expenditures for last year \$100,000 as the estimated value of taxes "worked out." It is encouraging to note that the County Highway Commission expects to buy two complete road equipments, and it is to be hoped that these will not be entrusted to those who are working out taxes but will be operated by a regular force. We have yet to learn of a county, township or other political unit which has obtained, from this working out of taxes, results satisfactory to any one except those who thus avoided paying out real money by doing a little half-hearted, unintelligent, and often worse than useless, work on the roads in their vicinity.

Constructing a Concrete Road in Nebraska*

By A. S. Mirick†

Round, water-worn gravel of feldspar and quartz, the only material available in the state, was tested for use as the concrete aggregate, making stronger concrete than Potomac River gravel, and is now being used for six miles of the Lincoln Highway.

Nature has been niggardly to Nebraska in the matter of bestowing materials for hard-surface roads. The stone supply is confined to the southeastern portion of the state, and consists of limestone deposits of varying hardness. Some samples show a French coefficient of wear of eight, but the hard strata are so distributed in the quarries that it is almost impossible to get a uniform product that would be suitable for an aggregate for concrete pavement.

The Platte river runs through the central part of the state, and for ages it has been rolling down the feldspar and quartz rock from the Rockies and depositing the same in Nebraska; so that in many places this material is pumped up, screened and graded, and makes splendid aggregate for concrete. The material in question, however, violates a favorite condition that engineers have made a part of their fine aggregate specifications, viz.; that the particles must be sharp. This theory has been proven fallacious, for the rounded particles, if they are clean and hard, have been found to develop more strength than the sharp variety.

The material pumped up from the Platte river has another characteristic that has caused engineers to be cautious, that is its fineness. One who is familiar with Prof. Abrams' tests, knows that he has developed a theory that if a material shows a certain modulus of fineness, depending upon its grading, this material may be composed of any

sized aggregate. Even the grading is relatively unimportant in comparison with water content. With this theory in mind, it was decided to send a sample of the Platte river material to the testing laboratory of the Bureau of Roads, Department of Agriculture, Washington, to determine whether so called Platte river gravel would meet with their approval for use on concrete paving work in Nebraska. This matter was an important one as it meant utilizing the greatest supply the state has for paved road. The analysis of the sand-gravel mixture was as follows:

Passing $\frac{3}{4}$ " mesh screen and retained $\frac{1}{2}$ " screen..	2.0
" $\frac{1}{2}$ " screen and retained $\frac{1}{4}$ " screen.....	12.7
" $\frac{1}{4}$ " screen and retained $\frac{1}{8}$ " screen.....	85.5

Retained on $\frac{1}{4}$ " screen.....	Per cent.	14.7
Passing $\frac{1}{4}$ " mesh retained on 10 mesh.....		44.4
Passing 10 " " " 20 "		27.9
Passing 20 " " " 30 "		5.5
Passing 30 " " " 40 "		3.1
Passing 40 " " " 50 "		1.3
Passing 50 " " " 80 "		1.9
Passing 80 " " " 100 "		0.2
Passing 100 " " " 200 "		0.5
Passing 200 "		0.5
		100.0

Loss by washing silt and clay..... 0.4

The sample consisted essentially of rounded fragments of granite, quartz quartzite, with a large amount of subangular quartz sand.

Samples of the material were tested for com-

*From The Cornell Civil Engineer, slightly condensed.
†Chief construction engineer, Nebraska Department of Public Works.

pression and compared with Potomac river screened gravel. The mixture of the Platte river sand-gravel was one part of cement by volume to three parts of the sand-gravel.

The Potomac river material was used in proportion 1 part of cement, $1\frac{1}{2}$ part of Potomac river sand, and three parts of Potomac river gravel measured by volume. The dividing line between sand and gravel, of course, being $\frac{1}{4}$ " mesh screen; all that was retained on this screen was considered gravel, and all passing through considered sand.

6" x 12" cylinders were prepared of concrete made from both materials and aged 7 days. Two test samples were prepared of each. The total loads sustained by the cylinders of Platte river gravel were 58,350 lbs. and 65,940 lbs. with an average of 62,145 lbs.

The total loads sustained by the cylinders of the Potomac river gravel were 57,780 lbs. and 58,180 lbs. with an average of 57,980 lbs.

The average unit crushing strength of the Platte river sand-gravel concrete was 2,198 lb. per sq. in. The average unit crushing strength of the Potomac river gravel concrete was 2,050 lb. per sq. in.

As a result of this test it was decided to use this material for paving with concrete a portion of the Lincoln Highway 5.94 miles in length running from Fremont to Ames.

SECURING AND HANDLING AGGREGATE.

The plans for this stretch of concrete paving called for a pavement 18 feet wide, the thickness in the center being 8 inches and the thickness on the sides 6 inches, the pavement being laid in blocks 36 feet long with a $\frac{1}{2}$ inch elastic expansion joint separating each block from its neighbor.

The Platte river runs parallel to this road and material for the aggregate could be obtained with very easy hauls direct from the plants operating along the river in the immediate vicinity of the road. Consequently the contract was let for the construction of the road at a cost of \$199,440.34.

The gravel is dredged from the shores of the Platte river. The effluent from the pump carries the sand and gravel to a series of sorting screens and chutes, where the fine and waste materials are returned to the lake pit. The material to be used is delivered into the bins ready for truck loading. The material is then hauled to piles located at convenient places along the road for storage. The hauling from the bins to the stock pile is done by trucks.

Near these stock piles a platform for storing cement bags has been erected, and all of the charges for the mixer are carried from the stock piles by means of Ford trucks. These Ford trucks are equipped with Lee dump bodies holding 21 cu. ft. of sand-gravel mixture. The sand-gravel mixture is loaded on the trucks by means of an automatic loader. This charge is rushed to the mixer, dumped, and the truck returns at a 50 miles an hour gait for another load. The advantages of this manner of handling material from the stock piles to the mixer over the old method of hauling by teams are as follows:

1. The sub-grade is kept in good condition ahead of the concrete by the action of the over-sized tires of the Fords.

2. The speed of operation of the trucks obviates the confusion and congestion that occur with teams, since many teams must be on the road to handle the same amount of material.

3. It eliminates the old time skinner, who sleepily dozed over a pair of mules, and utilizes the young man who has a real interest in motor vehicles, encouraging him to work at something he really likes and helping to solve the labor question.

4. Above all, it greatly diminishes the number of men required, and entirely eliminates the difficulties of using teams.

LAYING THE CONCRETE.

The concrete is mixed in a large three-fourths yard Foote concrete mixer. This mixer is equipped with caterpillar tractors that distribute the load of the mixer on the subgrade at a pressure of about $4\frac{1}{2}$ pounds per square inch. The ease with which this machine can be moved forward with little damage to subgrade makes it an ideal machine for concrete paving.

The forms used are Blaw-Knox pressed steel forms that combine the qualities of a form with a track to receive the Lakewood finishing machine which was used.

As soon as the concrete has set, if the temperature is high, the pavement is covered by a tarpaulin. This is removed after a short period and a covering of not less than two inches of earth is applied and kept moist for a period of at least ten days.

Sieve analyses are made of the sand-gravel aggregate from time to time. Very close watch is kept on the material to see that it conforms exactly with the specifications. Very little variation of the coarser material is allowed and any deficiency in this respect has to be adjusted.

This work is supervised by the Department of Public Works of the state of Nebraska aided by the government. The state places a project engineer on the work, who is supplied with such assistants as he needs. He is required to lay out the work, secure samples of material, and to be responsible for the inspection of the same. He makes a daily report to the department of material used and progress made. His work is also subject to inspection from time to time by the officials of the state and Department of Agriculture. He makes all measurements for estimates, and certifies the same.

This work, though it represents a small part of Nebraska's road building program, is being watched by engineers in the middle west with a great deal of interest, for on the result of this work may rest the solution of the problem of cheaper pavements for some of the central-western states that have no suitable material for coarse and fine aggregate. The successful use of the Platte river deposit will have a great influence in extending hard surface road systems in Nebraska and adjoining regions.

The great irrigation pump installed by the Glenn-Colusa Irrigation District is believed to be among the largest in the Western states. The discharge pipe of the pump is ten feet in diameter and throws 375 cubic feet per second. The pump is the seventh, and largest, to be installed at the head of the system to take water from the Sacramento river.

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Highways and Unprogressive Counties

In tabulating the data received by us during the past month or two, concerning county highway work, our attention was attracted by the very large number of new counties reported, especially in some of the Western states, where fully 50 per cent of those now existing have been created during the past four or five years. With the creation of new counties there naturally arise problems in connection with organizing officials and forces for county work, the chief of which in most cases is highway work.

As an illustration, the county engineer of one of the new Idaho counties informs us that that county was created by a bill passed in March, 1919, separating it from another county, the chief reason for the separation being the miserable condition in which the original county permitted its highways to continue. Says our informant: "None of our taxes were expended judiciously before we were made a new county and we are just getting ready to co-operate with the State and Federal aid" on the construction of some of the principal routes in the county. The chief of these routes is 45 miles long and 14 miles has already been surveyed and plans and specifications prepared. Also the new county expects to hard-surface this season approximately six miles of another route, twenty miles of which has been surveyed. Outside of this hard surfacing, the county expects to build twenty miles of dirt road and rebuild six wooden bridges, two steel bridges, two concrete bridges and eighteen culverts of corrugated steel.

This is quite an ambitious program for a county only 12 months old, and apparently justifies the withdrawing of it from the old county under which no road work was carried on. It is quite possible that a number of other subdivisions into new counties were occasioned by similar dissatisfaction with unprogressive elements in portions of the old counties; in fact, we have been informed that this was the case in a number of such instances.

The question suggest itself, what will be the effect of this subdivision upon the unprogressive sections, which are thus left alone in their unprogressiveness? Also, should one of these un-

progressive counties lie across the route of a proposed interstate or transcontinental highway, how would it be possible to secure the improving of such section of the highway? Does not this furnish an argument for nationalizing the more important highways in order to prevent this occasional break in long, continuous routes which, throughout the rest of their course, are kept in the best of condition for both pleasure and commercial traffic?

More Equitable Construction Contracts

The general contractor usually spends so much time and money in making ten costly estimates for every contract that is awarded him, and then is so intent on making a living profit, or in coming out whole on the job, that he has accepted the condition of almost universally permitting the owner's attorney to write the contract and the owner's engineer to write the specifications. These contracts and specifications hold the contractor to the most rigid execution of an agreement which is often arbitrary and is invariably drawn to give the major advantage to the owner and generally to throw all risks and responsibility on the contractor, leaving him little to gain and much to lose by almost any unforeseen contingency, change or delay.

There are few competent judges who have studied the situation but have, for many years, strongly urged the adoption of a more equitable and considerate treatment for the contractor and less drastic and one-sided covenants which the contractor is practically compelled to sign in order to have any opportunity of doing work.

Government and municipal owners have been the worst offenders, in that their power is usually greater, that their officers in charge of the work usually have little discretionary power or dare not use it if they have, and that, in case of litigation, their legal resources and privileges are much greater than that of the average contractor.

In attempting to ameliorate this condition, a special committee of the Associated General Contractors of America has studied more than 100 different forms of contracts and has formulated modifications and additions calculated to secure high-class work at a reasonable cost, protect the interest of the owner and at the same time safeguard the contractor against some of the more common injuries and unnecessary risks to which he is often subjected without compensation.

The proposed contract provisions, which are reprinted on page 499, have to do chiefly with the elements of time, market fluctuations, conditions over which contractors have no control, surety bonds, payment, changed quantities and arbitration. Under all of these heads, there have been many notable cases in which the contractors have suffered unjustly and often very seriously. There are few if any cases on record in which the owners have suffered directly from the same causes.

The recommendations are evidently made with the spirit of fairness and, in most cases, tend to improved conditions and to evenhanded justice for both parties. Some of these clauses are already substantially incorporated in existing contracts and others probably will be easily made acceptable to owners. Among those seldom found at present are

the proposed limitation of retained percentage, the systematic proportionate reduction of the surety bond as the work progresses, the sliding scale for unit prices when quantities are changed, and arbitration as last appeal for interpretations and decisions.

Of these the last two are probably the most important and perhaps the most difficult to make acceptable to owners. They are absolutely just and should be vigorously maintained because, without jeopardizing the owner, they protect the contractor against conditions that very many times have caused him serious loss and sometimes complete ruin.

The clauses providing for a modification of the contract bid and a sliding scale of prices to offset changes in the market prices of labor and material and freight are sound in principle, but should not be applied too far; that is, a certain amount of risk from such changes should properly be assumed by the contractor, but when the changes are great enough to involve more than a reasonable percentage of his justifiable profit, they should be covered by some such arrangement as is proposed.

The list does not mention a very important provision which should be made, to the effect that in any contract the execution of which necessarily conflicts with any federal, state or municipal laws or requirements or in which the proper execution of the contract involves unavoidable property damages, the owner should assume responsibility, and that the owner should also assume responsibility for the direct results of the contractor's compliance with the engineer's orders to do or refrain from doing certain things.

The Most Hazardous Industry

An analysis of the income tax returns made by a committee of experts shows that for each dollar of profit made by construction corporations, the loss is eight times as large as it is in manufacture or agriculture, five times as great as for transportation and public utility corporations, and three times as great as for mining, which is often considered as little better than gambling.

To a considerable extent this risk is unavoidable because the engineering contractor almost invariably covenants in advance, sometimes several years in advance, to perform difficult and important work for a previously fixed amount, usually not greatly in excess of a careful estimate of the exact cost, and under conditions that range from totally unknown quantities and price costs to well-known quantities that may suffer considerable arbitrary change.

Often many vital conditions are entirely unknown and can be disclosed only by the progress of the work, and nearly always, especially of late years, there is possibility if not strong probability of great increase in the cost of labor and materials that form a very large part of the total costs.

The work is often imperiled by hazards such as floods, fire and political, financial and industrial disturbances which the contractor can neither foresee nor safeguard himself against. In addition, most important contracts are subject to more or less change of design and delay in execution, both of which, in nearly all cases, cause serious loss to the contractor. The contractor is subject to great depre-

ciation of plant, high overhead and numerous extraordinary expenses, some of which easily escape due recognition in the estimate and bid.

Inexperienced contractors almost invariably fail to make sufficient allowance for these risks, and this makes the total losses greater and the difficulties harder for the competent contractor, for, although the first time that the inexperienced ones fall into serious difficulties they are likely to go bankrupt, new ones constantly appear with unduly low bids which seriously injure the conservative contractors.

There are only two remedies and they but partially eliminate the danger; first, no inexperienced contractor should undertake an unfamiliar, complicated or hazardous work or any work not showing proper allowance for overhead, for contingencies, for all fixed charges, for personal salary and for a reasonable profit allowing for a margin of delays and market fluctuations in items that cannot be provided for by preliminary engagement.

The other remedy lies in the very material modification of the terms of the contracts ordinarily accepted by contractors. Many of them are entirely unfair to the contractor, placing all the risk and responsibility on him and allowing him no corresponding opportunity for extra gain, even if he is foolish enough to gamble on the chances. Some contracts, and unfortunately those used by some powerful municipalities, are notoriously unjust to the contractor, who may have small chance of coming out even unless he can find some way to secure extras, allowances, or even to get away with inferior workmanship or materials or deficient quantities. Other contracts are so vague and indeterminate that they really depend entirely on the arbitrary decisions of the engineer and inspector who can, and sometimes do, absolutely ruin a contractor by their decisions. In these cases, the contractor should absolutely refuse to bid until the contracts are made just and fair, the objectionable clauses are eliminated, and safeguards are inserted.

Forest Products Engineers Wanted

The United States Civil Service Commission announces examinations for an engineer in forest products at a salary of \$2,160 to \$3,600, and an assistant engineer in forest products at a salary of \$1,500 to \$2,100. The positions are open to all citizens of the United States, both men and women. The duties will be to plan investigative tests dealing with the physical and mechanical properties of wood, processes of preserving wood, practical problems of the pulp and paper industry, wood distillation, naval stores industry, or other problems involved in the utilization of wood; to make or supervise the making of such tests, compile analyses, prepare reports, and present the results of researches to either the public or private individuals.

Competitors will be rated on their education and experience, upon their own sworn statements made in their applications and upon corroborative evidence, there being no examination given. No age limit is set. Applications must be filed with the Civil Service Commission at Washington by June 22. Further information can be obtained from the commission.

Disposal of Municipal Wastes

By Joseph Goder

Continued from page 474 of the previous issue. In this instalment the author discusses the reclamation of the fuel value of the different kinds of waste.

RECLAMATION OF FUEL VALUE OF WASTE.

This method of refuse disposal is so important and far reaching, and at the same time so little appreciated in this country, that we feel compelled to deal with it more explicitly.

It is universally conceded that the conversion of refuse into heat or the destruction of refuse by fire is the most desirable method from a sanitary point of view. Frequently grave objections are raised in regard to the economic side of this process. However, these objections hold true in very few instances, and if the disposal problem as a whole is considered, close investigation will reveal also the financial advantage of this method.

The reasons for this misapprehension are the fact that the crematories generally used are absolutely inadequate for the proper combustion of city refuse, and the superficial improper design of the entire disposal system.

All waste matter contains a certain amount of fuel value which can be utilized to aid its disposal and may be converted into heat units and commercially exploited.

We have already called attention to the necessity of determining the thermal value of each kind of refuse. It may be opportune to give a few more pointers in this regard. Following the classification previously given, sewage, or rather the solids contained in sewage, may be reviewed first.

The most widely used sewage treatment is the separation of all or at least the major part of the solids of sludges. Various methods are employed to effect this separation. It is outside of the scope of this article to dwell on the different methods and we only mention a few facts to be considered in connection with the final disposal of the sludge by incineration.

Some of the processes employed have a direct effect on the calorific value of the sludge. In deciding on the method to be employed, this important fact is often overlooked. The disposal, or rather utilization, of the sludge is a more vexing problem than the sludge separation or the production of a satisfactory effluent. Sludge subjected to biological treatment—from Imhoff tanks or otherwise—contains a lower heat value than untreated sludge, the action of the micro-organisms having reduced the organic constituents, while the mineral and unorganic matters are only slightly affected. This is one reason why in some instances experiments to incinerate sludge have failed, notwithstanding a reduction of the moisture content effected by a secondary treatment. The composition of sludge varies according to local conditions

affecting their heat value. We have reports of sludge containing as much as 15,000 B. t. u. and more (Kershaw reports sludge from the city of Dortmund to contain as high as 17,120 B. t. u. dry). An average fuel value of 7,500 B. t. u. may be safely assumed. This value is sufficient to permit at least auto-combustion of sludge containing from 50% to 60% of moisture, provided suitable furnaces are employed. Sludge drawn from the settling tanks contain from 88% to 95% moisture. This moisture content must be reduced if the sludge is to be disposed of by any practicable method. From a pure technical viewpoint this is easily done; however, economic and aesthetic considerations are more difficult to overcome. Reduction of the moisture content by mechanical means (pressing, centrifugalizing) involves considerable expense. Utilizing natural heat and air in sludge beds is confronted by aesthetic and hygienic obstacles. It appears to the writer that the most logical plan to follow is to use the contained properties of the sludge to overcome the obstacles or to effect its own drying disposal. This is satisfactorily accomplished abroad. The failures experienced with the conversion of sludge through its own fuel value are solely due to the faulty design of the means (primarily the faulty design of the incinerators or producers).

Night soil hardly enters into consideration as a class of refuse to be separately treated. In most communities having a sanitary sewer system this material forms a part of the sewage. Communities not equipped with sanitary sewers are as a rule of a rural character. The utilization of this valuable fertilizer in its natural state offers no serious obstacles. Its fertilizing value certainly outweighs manifold the harmless inconvenience produced by its effluvia. The humification and mineralization of the faeces and other ingredients progress rapidly, especially as the distribution of this matter assures a thorough aeration, and absorption of oxygen. Sporadic local conditions, epidemics or pathogenic excreta from hospitals call for other disposal means. In such cases evaporation and incineration are the proper procedures.

The calorific value of garbage is frequently underestimated. Most garbage contains sufficient heat value to effect its own incineration under favorable conditions. With an average moisture of 70%, the average city garbage possesses 1,500 B. t. u. per pound as collected. Rubbish and ashes as collected can safely be estimated to produce 5,000 B. t. u. per pound. The sorting of salable material will not greatly affect the heat value of rubbish. It merely reduces the quantity of rubbish to be incinerated. The calorific value of ashes is sufficient to warrant its reclamation in many cases. Street sweepings and stable manure contain likewise a fuel value in excess of 2,000 B. t. u.

As afore mentioned, one of the prime advantages of utilizing the heat value of city refuse is the general adaptability of this method. Thus, not only the entire collection and disposal system is greatly simplified, but also its reliability is enhanced. We have mentioned this fact previously in connection with the discussion of other disposal means. A well designed forced-draft refuse furnace or incinerator should produce from the average mixed city waste

at least one pound of steam per pound of refuse above the steam required for the forced draft. Utilization of this steam power can be found in most cases. Sewage disposal plants, garbage reduction plants, water works, etc., offer a ready outlet for the excess power. Electric current can be generated to light public buildings. A city yard, stables and repair shop form an ideal location for a refuse disposal plant.

The clinkers from a forced draft incinerator plant are a valuable by-product generally not taken into consideration. These clinkers are a most desirable material for biological filterbeds and demand high prices. For concrete and road work they are of considerable value.

A point to be considered is the location of the disposal plants. A modern incinerator plant is absolutely free of any nuisance from smell or soot, and may be centrally located, an advantage not possessed by any other process. A division of the entire disposal system into different plants properly distributed reduces the collection cost. Large units increase the cost of hauling. We would, however, recommend, in order to utilize the heat value economically, to provide for units not smaller than 50 tons daily capacity (preferably 75 to 150 tons). However, local conditions and consideration of utilization of the heat value largely govern this decision.

As mentioned before, the faulty design of most refuse furnaces is to blame for the antagonism against incineration. A few of the characteristics a successful refuse furnace must possess are here inserted.

High furnace temperatures are a condition of cardinal importance. High furnace temperatures can be maintained only by a forced draft, allowing reduction of excess air to a minimum and producing a high ratio of combustion. All heat-absorbing surfaces in the furnace chamber shall be eliminated. Combustion room temperature shall average at least 1,500° F. and at no time during operation shall it drop below 1,000° F. Furnace gases on their way to the combustion chamber shall not travel over wet material, so as not to reduce their temperature below the ignition point. Large combustion space must permit full expansion of the gases. Waste heat should be recuperated and utilized to preheat air for combustion. All incombustible matter should be molten homogeneous clinkers. Sifting of incompletely combusted particles into the ashpit should be eliminated. Furnace shall be fed in small charges so as not to reduce furnace temperatures temporarily. Refuse shall be fed into the furnace in a way not offensive or injurious to the health of the operators.

All these conditions must and can be maintained in a properly designed incinerator plant. They have been complied with in all modern installations abroad and there is no reason why we should be satisfied with inferior design, handicapping the successful solution of our disposal problems. Claims that conditions in our country vary widely from conditions met abroad and that different furnaces could be used can not be sustained, as every one familiar with the problem knows, and these claims are disproved by existing installations.

Hetch-Hetchy Bond Litigation

As recently noted in Public Works, an important contract has just been awarded by the city of San Francisco to the Construction Company of North America for driving an 18-mile aqueduct tunnel through the Sierra-Nevada Mountains for the new Hetch-Hetchy Water Supply. There has been considerable opposition to the work and much difficulty has been encountered in financing it because the city wishes to pay for it with bonds which are not saleable at par and which its charter prohibits it from selling below par.

The contract was finally awarded on the cost-plus-fee basis and a suit has already been instituted for an injunction to prevent the city from making the initial payment of \$276,000 on the contract. Another suit has been filed against the treasurer of the Construction Company, whose attorney states that the work will not be halted by the injunction, and that the Construction Company itself will immediately buy from the city at par and accrued interest, \$571,000 worth of Hetch-Hetchy bonds. The Construction Company has volunteered to place \$600,000 cash in the city treasury to give it working funds for the next two months and to wait for the contractor's fee until the legal difficulties are untangled.

Plans have been very carefully prepared for an exceedingly valuable water supply and hydro-electric power plant for the city and considerable preliminary work and money have already been expended on them. In comparison with other similar projects, it does not appear that this is either ill-considered or unduly costly, and as it is urgently needed and the costs have been rapidly increasing and are likely to go still higher with further delay, the work should be promptly executed and no malicious or artificial obstacles placed in its way. The officials in charge are entitled to great credit for their courage and ability in carrying the project so far along through the recent difficult times and should be aided to the utmost rather than hindered.

Water Filtration for Detroit

The city council of Detroit has authorized the issuing of twelve million dollars of public utility bonds, subject to approval by 60 per cent of the voters at the August election. The object of this bond issue is the construction of a filtration plant. Experiments have been under way for two years with a view to determining the details of filtration most suitable to local conditions and plans for the plant have been prepared. (See Municipal Journal & Public Works for May 10, 1919.) Machinery has been purchased and the contract let for a low lift pumping station which will increase the capacity of the present pumping station and later will form a unit of the new filtration plant. If these funds are voted, it is hoped to be able to furnish purified water in about four years. The proposed plant is calculated to supply 300 million gallons per day, although there is anticipated an average consumption of only about 200 million gallons by 1930. The plant will therefore provide for a temporary increase of fifty per cent over the average for six years after its completion.

Contract Provisions Proposed by Contractors

Report of a committee of the Associated General Contractors recommends the incorporation in all contracts of several provisions dealing with fluctuating costs, partial payments, stopping work, bonds, penalties, inspection, extra work, arbitration, and other points.

The Committee on Contracts of the Associated General Contractors of America during the past year has made a study of 113 different forms of contracts of various types. As a result of this study the committee approves certain provisions, and recommends that they be included in every contract made by members of the association.

Commenting upon the general subject of contracts, the committee states that "an analysis of income tax returns shows that contracting is the most hazardous industry in the country," the loss for each dollar of profit made by construction corporations being eight times as great as it is in manufacture, agriculture, or personal service corporations; five times as great as in transportation and public utility corporation; over three times as great as in mining and quarrying, and nearly twice as great as in banking. It argues that the more such uncertainties can be eliminated, the lower will be the costs of construction to the owner, the more satisfactory will be the relations of the architect or engineer with the contractor, and the more will contracts be awarded on a basis of skill, integrity and responsibility.

"From the very nature of construction, many of these uncertainties can never be eliminated. They must be assumed by either the contractor or the owner. Some which are now assumed by the contractor ought by right to be assumed by the owner. Other uncertainties may be eliminated entirely to the advantage of both parties. The improvement of present contract provisions is one of the simplest solutions for this problem."

The provisions proposed to secure the results referred to are given as follows in the report of the committee:

Proposed Contract Provisions

1. *Action on Bids.*—Bids should be submitted with the provision that they must be acted upon within a reasonable time.

2. *Freight Rate Changes.*—Bids should be submitted on the basis of existing freight rates, with the provision that in case a change in rates should occur between the time bids are received and the date fixed for the completion of the contract, the contract price should be increased or decreased accordingly.

3. *Wage Scale Changes.*—Bids should be stated and be submitted on existing wage rates, with the provision that the contract price shall be increased or decreased in accordance with any change in such rates before the date fixed for the completion of the contract.

4. *Material Price Changes.*—Bids should be submitted on the basis of existing prices for materials f. o. b. the producer's plant or distributor's yard, with the provision that the contract price shall be increased or decreased in accordance with any change in such price that takes place

within the time allowed the contractor to purchase and fabricate his materials.

5. *Monthly Estimates.*—Monthly estimates should include materials delivered and suitably stored as well as materials incorporated in the work.

6. *Partial Payments.*—Certificates should be prepared and delivered to the contractor between the first and tenth day of each month, showing the proportionate part of the contract price earned during the preceding month. These certificates should be paid by the owner by the tenth day of the month. Interest on deferred payments should be paid the contractor at the prevailing rate.

7. *Contractor's Right to Stop Work.*—Under the following conditions the contractor should have the right to stop work or terminate the contract upon three days' written notice to the owner and the architect, and recover from the owner payment for all work executed and any loss sustained upon any plant or material and reasonable profit and damages:

(a) If the work should be stopped under an order of any court, or other public authority, for a period of three months, through no act or fault of the contractor or any one employed by him;

(b) If the architect or engineer should fail to issue the monthly certificate for payment in accordance with the terms of contract;

(c) If the owner should fail to pay the contractor, within seven days of its maturity and presentation, any sum certified by the architect or engineer or awarded by arbitration;

(d) If the owner does not permit the contractor to proceed with construction within a reasonable time after signing the contract.

8. *Retained Percentage.*—The retained percentage should be based on 100 per cent of the work performed and should never exceed 10 per cent. When the amount retained reaches a total sum, which shall be mutually agreed upon by the owner and the contractor, no further reduction from payments should be made.

9. *Surety Bond.*—Where a surety bond is given, it should be reduced at agreed intervals so as to cover thereafter only that portion of work then uncompleted.

10. *Penalty Clauses.*—Wherever any provision is incorporated in the contract for a penalty against the contractor (including liquidated damages), there should also be inserted a provision for a bonus of like amount.

11. *Acts of God or Public Enemy.*—The contractor should not be held liable for results arising from the acts of God or a public enemy.

12. *Time Allowed for Completion of Work.*—The time allowed for the completion of the work should be based on "weather working days" instead of on elapsed time, and, if necessary, allowance should be made for time spent in performing unproductive work made necessary by floods or other natural causes beyond the control of the contractor.

13. *Inspection.*—Where practicable, materials should be inspected at the source so that costly delay may not result from the rejection, at the site of the work, of materials furnished in good faith by the contractor.

14. *Force Account Work.*—Payment for force account work should be made on the basis of the total actual costs of the work, including the actual labor and material costs, rental on equipment, liability insurance, etc., plus a reasonable percentage to cover overhead and profit, total to be not less than 15 per cent.

15. *Change in Quantities.*—In case the actual quantities of any item in a unit price contract are less than the estimated quantities by more than a certain fixed per cent, the unit price paid the contractor for that item should be increased by an amount to be agreed upon. Similarly, a decrease in the unit prices should be made in case the quantities are increased over the estimate by more than a certain fixed per cent.

16. *Arbitration.*—In no case should the engineer or architect be made the final judge as to the interpretation of the drawings and specifications or the performance of the contract. All decisions and interpretations should be subject to prompt arbitration at the choice of either party to the dispute.

Foreign Attitude Towards Emigration

It is reported from Washington that more than 600,000 persons from most of the European countries except Germany, Austria, Hungary, Russia and Turkey have applied for permission to enter the United States. In some countries, emigration is discouraged if not prohibited, and difficulty and delay are experienced in securing passports permitting emigrants to leave, besides which there are trouble, expense and formality in securing permission to enter this country. The matter should be simplified and so arranged as to be completely conducted at the frontiers of the foreign countries.

All officials should admit and welcome all honest, industrious, law-respecting workers who are willing to come to this country for the sake of making themselves homes and becoming loyal citizens. Those that are incompetent, vicious, doubtful, or that have radical political opinions, should be rigidly excluded by investigations conducted on the other side. Good health and decency should be the principal assets required and money and literacy requirements should be relaxed at present.

The opposition of foreign governments can retard but cannot wholly prevent immigration to America. The difficulty that must be anticipated and safeguarded against is that indicated by the reported statement of a member of the Italian Chamber of Deputies who is reported to have said: "Emigration is again our safety valve. The police would like to sweep out these people as soon as possible." It has further been stated that foreign officials issued certificates of good character to applicants whose previous criminal records had already debarred them from acceptance by the United States officials.

Such conditions should, of course, be carefully investigated. They are probably very much in the minority and most of the emigrants can be made acceptable and valuable. A Congressional committee is now investigating the procedure for examining and rejecting or accepting immigrants in their home countries. Properly carried out, this should afford a satisfactory alternative to the exclusive measures demanded by labor leaders and the unrestricted welcome that some industrial interests would extent.

Immigrants Steadily Arriving

According to the Ellis Island records, thirteen steamships, bringing from 104 to 1,900 immigrants each, landed a total of 8,912 at Ellis Island during the week ending May 22. Assuming that this is about 80 per cent of the total number of aliens arriving at all ports of the country, it would mean

about 11,000, a slight falling off from some previous weeks, but still a sufficient number to show the positive influx of labor that is so much needed.

It should be remembered that facilities for passenger transportation from Europe have been tremendously decreased since before the war so that difficulty is encountered by the foreigners in securing passage and it probably taxed most of the available space in the thirteen ships mentioned to bring out the number that they did bring. Few of these ships were large as compared with some of the great liners, like for instance the *Cleveland*, the *Pennsylvania* and others, which in former days would bring more than 2,400 in their steerage, but are no longer available, not less than twenty-five of these boats, with a combined capacity of 40,000 passengers for each trip, having been subtracted from this before-the-war list. If they were still plying between European and United States ports, the number of immigrants would doubtless be much greater and would probably increase more and more rapidly notwithstanding the passport restrictions which delay and obstruct their arrival.

The quite natural policy of the foreign nations to send us their undesirables and keep their industrious labor at home is diametrically opposed to what should be our policy. We, perhaps, cannot be quite as strict in the entrance requirements as we would be if our need for labor was less, but with moderate restrictions intelligently carried out, there is no doubt that many desirable immigrants, fleeing from severe conditions abroad, will come to our shores in increasing numbers, and, if properly treated, Americanized, and distributed, would gradually relieve the labor famine which is a very real menace to our prosperity.

We should remember that Europeans are not the only aliens that can help do our work. Chinese, Mexicans, West Indians and others are available and under proper restrictions and regulations should be admitted despite the protests of the labor unions.

Advices from Chicago state that the manufacturers there report an improved mental attitude of laborers reducing the turnover and showing for the first time in many months a slight improvement in general labor conditions.

Admitting Chinese Laborers

Writing a few days ago, John Ericson, whose letter suggesting the importing of Chinese laborers was published in our issue of May 15, informed us that he had heard from more than one thousand engineers, located in every state of the union, and that, of these, 61 per cent favored importation of Chinese labor, 7½ per cent favored importation of some labor, 8½ per cent favored other immigration, 10 per cent were against any immigration, 9½ per cent were neutral, 1 per cent advocated wider use of labor-saving machinery, and 2½ per cent were awaiting further information.

A number of those who favor the project have decided to organize a committee representative of engineers from all over the United States, to press the matter and presumably urge action by Congress calculated to bring about the importation of Chinese labor.

Recent Legal Decisions

CONTRACTS.

LEGALITY OF OBJECT AND OF CONSIDERATION.

(N. Y. Sup.) Buyer's bond to indemnify seller against liability for damages to third party, to whom seller had previously contracted to sell the goods, *held* unenforceable, having been executed as an inducement to seller to break contract with third party, and therefore being based on an illegal consideration, and having been executed for illegal purpose.—*Hocking Valley Ry. Co. v. Barbour*, 179 N. Y. S. 810.

Restrictive stipulations in restraint of trade in agreements between employer and employe are not viewed with the same indulgence as are such stipulations between seller and buyer of a business and its good will.—*Samuel Stores, Inc., v. Abrams*, 108 A. 541.

(N. Y.) Parties cannot undertake by an independent provision of a contract to provide for adjustment of differences arising in its performance by arbitration to the exclusion of the courts.—*Saratoga State Waters Corporation v. Pratt*, 125 N. E. 834.

(N. Y. Sup.) Evidence *held* insufficient to warrant holding that a contract, between corporations involved in the litigation, providing for dissolution of a third corporation formed by them to bid upon and perform subway contracts, either was the result of mistake or was in violation of any laws of New York having reference to the rights of stockholders.—*O'Rourke Engineering Const. Co. v. Booth & Flinn*, 179 N. Y. S. 623.

PERFORMANCE OR BREACH.

(Cal.) The failure or refusal to perform an obligation assumed expressly or by implication, or the voluntary abandonment of the contract, releases the obligee from the duty of making demand.—*Walker v. Harbor Business Blocks Co.*, 186 P. 356.

(Utah) Where a subcontractor doing the painting on a school building, after being warned that defective materials would not be accepted, falsely assured the inspector for the school authorities that the materials used were substantially those specified in contract, any acceptance of the work based on such false representations of the subcontractor is not binding so as to prevent the general contractor, who would be required to make the deficiency good, from recovering from the subcontractor damages resulting from his failure to comply with the specifications.—*Board of Education of Salt Lake City v. West*, 186 P. 114.

(Utah) Payment by contractor to subcontractor of a sum to apply on the sub-contract, made before contractor knew that materials used by subcontractor were inferior and not in substantial compliance with the specifications and contract, was not a waiver of such defects.—*Board of Education of Salt Lake City v. West*, 186 P. 114.

(Tex. Civ. App.) Where subcontractor's contract with road contractor was made subject to all of the conditions and limitations contained in the contract

between contractor and county and where such contract did not require contractor to furnish gravel, subcontractor could not recover against contractor for damages sustained by reason of inability to complete work, where such inability was due to default of county to furnish gravel.—*Hartwell v. Fridner*, 217 S. W. 231.

(Cal.) The failure or refusal to perform an obligation, assumed expressly or by implication, or the voluntary abandonment of the contract, releases the obligee from the duty of making demand, and performance or tender, and justifies him in abandoning the contract without waiting until the contract period expires, and gives him immediate right of action for the breach and to rescind.—*Walker v. Harbor Business Blocks Co.*, 186 P. 356.

(La.) Civ. Code, art. 2765, declaring that the owner may cancel a building contract "at pleasure," but that in such case he must pay the undertaker for the work done and expenses incurred, and such damages as the case may require, has no application where one contract has been superseded by another with the consent of both parties, and the same undertaker appears in both contracts.—*Savings & Homestead Ass'n v. Frank*, 83 So. 491.

(Cal. App.) Forfeitures are not favored by the courts; every intendment and presumption being against person seeking to enforce the forfeiture.—*Horton-Howard v. Payton*, 186 P. 167.

ACTIONS FOR BREACH.

(Ala.) If a contract has been fully performed, except payment, or if breached or prevented of performance by defendant, or abandoned by mutual consent, the plaintiff may recover on common counts the amount due, or, as the case may be, for damages for breach of contract.—*Moundville Lumber Co. v. Warren*, 83 So. 479.

(Ala.) In declaring upon a contract, the pleader must either set out the contract literally or state its legal effect, averring the facts showing defendant's obligation.—*Moundville Lumber Co. v. Warren*, 83 So. 479.

In declaring on a contract, the pleader must either set out the contract literally or state its legal effect, averring the facts showing defendant's obligation, and, if on parol contract, stating the consideration.—*Moundville Lumber Co. v. Warren*, 83 So. 479.

(Mo. App.) Plaintiff cannot plead one contract and recover on another, and cannot recover on a contract, an essential part of which is omitted in pleading.—*Wamsganz v. Blanke-Wenneker Candy Co.*, 216 S. W. 1025.

(Tex. Civ. App.) In subcontractor's action against road contractor for damages sustained because of contractor's refusal to furnish gravel wherewith to perform subcontract, where petition alleged an express agreement by contractor to furnish gravel, proof of a contract whereby contractor did not either expressly or impliedly agree to furnish gravel was not admissible; such proof being a material variance from contract pleaded.—*Hartwell v. Fridner*, 217 S. W. 231.

NEWS OF THE SOCIETIES

June 7-10.—INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE. Annual convention, Detroit, Mich. Secretary, James L. Beavers, Chief of Police, Atlanta, Ga.

June 16-17.—LEAGUE OF MINNESOTA MUNICIPALITIES. Annual convention, Bemidj, Minn. Executive Secretary, E. L. Bennett, University of Minnesota, Minneapolis, Minn.

June 16-18.—NORTH CAROLINA GOOD ROADS ASSOCIATION. Annual convention, Asheville, N. C.

June 19-21.—TRI-STATE WATER AND LIGHT ASSOCIATION. Tenth annual convention, Atlanta, Ga. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

June 21-23.—CANADIAN PUBLIC HEALTH ASSOCIATION. Annual meeting, Vancouver, B. C. General Secretary, R. D. Defries, M. D., Toronto, Ont.

June 21-25.—AMERICAN WATER WORKS ASSOCIATION. Annual meeting, Montreal, Canada. Secretary, John M. Diven, 153 West 71st Street, New York City.

June 21-25.—INTERNATIONAL ASSOCIATION OF ROTARY CLUBS. Annual convention, Atlantic City, N. J. Secretary, Chesley R. Perry, 910 South Michigan avenue, Chicago, Ill.

June 22.—JOINT COMMITTEE ON STANDARD SPECIFICATIONS FOR CONCRETE AND REINFORCED CONCRETE. Next meeting at Asbury Park. Secretary-Treasurer, D. A. Abrams, Lewis Institute, Chicago.

June 22-25.—AMERICAN SOCIETY FOR TESTING MATERIALS. Asbury Park, N. J. Office of secretary, Philadelphia.

June 29-July 2.—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Annual convention. Secretary, F. L. Hutchinson, 33 West 39th street, New York.

July 6-8.—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS OF THE STATE OF NEW YORK. Annual conference, Jamestown, N. Y. Secretary, William P. Capes, 25 Washington avenue, Albany, N. Y.

July 26-30.—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual convention, Toronto, Canada. Secretary, Stephen E. Hoey, Municipal Building, New York.

Aug. 30-Sept. 3.—AMERICAN PUBLIC HEALTH ASSOCIATION. San Francisco. Office of secretary, Boston.

Sept. 7-10.—NEW ENGLAND WATER WORKS ASSOCIATION. Annual convention, Holyoke, Mass. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17.—AMERICAN PUBLIC HEALTH ASSOCIATION. Boston, Massachusetts.

Sept. 13-17.—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention, San Francisco, Cal.

Sept. 13-17.—SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, St. Louis, Mo. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ind.

Engineering Institute of Canada.

At a special conference held in Montreal, April 13, the societies' council was directed to appoint a committee on policy and to approve the establishment by the institute of rate of remuneration for its members.

LOCAL ASSOCIATIONS OF AMERICAN SOCIETY CIVIL ENGINEERS

Illinois Association. Organized 1916. A. F. Reichmann, president; W. D. Gerber, secretary-treasurer, 913 Chamber of Commerce, Chicago, Ill.

The regular meetings of the association are held on the second Monday of March, June, September and December, the last being the annual meeting.

Iowa Association. Organized 1920. J. E. Van Liew, president; R. W. Crum, secretary, Iowa State College, Ames, Iowa.

Louisiana Association. Organized 1914. A. T. Dusenbury, president; Eugene F. Deléry, secretary, 602 Sewerage and Water Board Building, New Orleans, La.

The regular meetings of the association are held at the Cabildo, New Orleans, La., on the first Monday of January, April, July and October.

Nebraska Association. Organized 1917. Clark E. Mickey, president; Homer V. Knouse, secretary-treasurer, 200 City Hall, Omaha, Neb.

Regular meetings of the association are held on the first Saturday of each month, except July and August, and at such places as may be appointed from time to time by the Executive Committee. The annual meeting is held in Lincoln, Neb., on the second Friday in January.

New York Section. Organized 1920. Robert Ridgway, president; Lewis D. Rights, secretary, 256 Broadway, New York City.

The annual meeting is held in May.

Northwestern Association. Organized 1914. Ralph D. Thomas, president; W. J. Jones, secretary, City Engineer's Office, City Hall, Minneapolis, Minn.

The meetings of the association are held bi-monthly, alternating between St. Paul and Minneapolis, on the third Friday of each month.

Philadelphia Association. Organized 1913. S. M. Swaab, president; Henry T. Shelley, secretary, 416 City Hall, Philadelphia, Pa.

The regular meetings of the association are held at the Engineers' Club of Philadelphia, 1317 Spruce street, on the first Monday in January, April and October, the last being the annual meeting.

Pittsburgh Association. Organized 1917. Morris Knowles, president; Nathan Schein, secretary-treasurer, 426 City-County Building, Pittsburgh, Pa.

The annual meeting of the asso-

ciation is held on the first Monday in October.

Portland (Ore.) Association. Organized 1913. J. C. Stevens, president; C. P. Keyser, secretary, 318 City Hall, Portland, Ore.

The annual meeting of the association is held on the second Friday in January. Other meetings are called by the president and are usually convened on Friday evenings.

St. Louis Association. Organized 1888 (constitution approved by board, 1914). Edward E. Wall, president; C. W. S. Sammelman, secretary-treasurer, 300 City Hall, St. Louis, Mo.

The annual meeting of the association, for the election of officers and for the transaction of business, is held on the fourth Monday in November. Two meetings each year, for the presentation and discussion of technical papers, are held in the Auditorium of the Engineers' Club of St. Louis and are open to members of the associated societies. Other "get-together" meetings are held regularly for dinner or luncheon on the fourth Monday of each month except July, August and November.

Municipal Engineers.

At a recent meeting of the municipal engineers of the city of New York, the special topic considered was the inadequacy of pay received by employees in engineering service. Statistics were presented showing that technical men in municipal service received considerably less remuneration than workers in New York building trades and average less than \$2,000 per year, while mechanics are being paid \$9 per day plus extravagant overtime wages.

The present scale of wages is responsible for lowering the morale of the city's engineering staffs and for the enormous turn-over of 450 per cent. in the Transit Construction Commission in the last six years. The resignation of able department heads on municipal service has caused a marked deterioration in the quality of engineers of the higher grades in municipal service.

The engineer who endeavors to show a low cost of engineering on his work by unduly reducing the technical payroll, was severely criticised. The civil service commission was referred to as an employment agency and it was stated that 5 per cent. of the municipal employees' personnel can profitably be weeded out each year, and that this should be done in order to protect the really valuable men. The city comptroller expressed his opinion that New York City has been "over-engineered."

Tri-State Water and Light Association.

At the 10th annual convention of the Tri-State Water and Light Association of North and South Carolina and Georgia at Atlanta, June 19-21, the subjects discussed will include fuel oil, filtration of water supply and water works extensions. There will also be a display and demonstration of manufacturers' exhibits.

California Section American Water Works Association.

The branch of the American Water Works Association to be known as the California section is now being organized in San Francisco.

PERSONALS.

Genglin, Otto, has been appointed city engineer of Texarkana, Texas.

Heber, Earl, superintendent for the Walsh Construction Co., Davenport, Iowa is in charge of the construction of a \$1,000,000 memorial bridge at Wilmington, Delaware.

Sias, R. M., has resigned as engineer of Galveston County, Texas, and opened an engineering office in Galveston.

Hansell, W. A., has resigned as superintendent of public works, Fulton County, Ga.

Miller, A. P., has been appointed assistant engineer for the Canadian Department of Public Works on the Trent Canal.

Latting, B. F., in charge of design of steel hangars for the Army Air Service at Washington, D. C., has resigned to accept a position of assistant chief engineer of the Indiana Bridge Company, at Muncie, Ind.

Wright, John B., has been appointed municipal manager of Springfield, Vermont.

Crawford, Robert, has resigned as superintendent of sewers of Akron, Ohio.

Aikman, H. N., has accepted a position with the Fargo Engineering Company, Jackson, Michigan.

Eichelberger, F. O., City Civil Engineer of Dayton, O., has been made Director of Public Service.

Toner, J. A., was recently appointed superintendent of public works, Meriden, Conn.

Campbell, G. L., has resigned as county engineer of Saline County, Kansas, to become division engineer of the Kansas State Highway Commission.

Boyd, M. C. W., has been appointed general manager and treasurer of the Good Roads Corporation of Kansas City, Mo.

Deleglise, A., has been appointed city engineer of Antigo, Wis.

Bauma, W. H., Omaha, Neb., has been appointed highway commissioner and surveyor of Thayer County, Nebraska.

Brambaugh, John, has been appointed county road superintendent of Huntington County, Indiana.

Starter, H. J., county surveyor of Siskiyou County, California, has been appointed county road engineer of that county.

Russel, G. A., has been appointed highway engineer of Geary County, Kansas.

Von Babo, Alexander, engineer of bridge design, Chicago Department of Public Works, died April 29th. He had had in this country many years experience including positions with the Delaware Bridge Co., the Iron City Bridge Works, Pittsburgh, the Union Bridge Company, and others and had been in the Chicago Department of Public Works since 1899. He assisted in the design of the Chicago type of bascule and invented the operating system therefor.

Winston, J. C., director of public works of Philadelphia, died at Germantown, May 6th. After being chairman of Philadelphia Charter Revision Committee and author of the public works clauses in the Charter, he was appointed director of public works last December.

Miller, J. E., prominent in Chicago's early engineering improvements, died at Evanston, Illinois, April 22nd. He had been connected with the design and construction of the first Chicago Water Works Cribs and sewage system, with the straightening of the Chicago River at its mouth and was associated at one time with the Chicago Dredging & Dock Co.

Bundock, Samuel, one of the original surveyors for the Northern Pacific Railroad in Montana, died at Warm Springs, Montana.

Jones, Major T. H., city engineer of Brantford, Ontario, for 37 years, died April 25.

INDUSTRIAL NOTES.

Automobile Truck Announcement.

E. A. Samels, of the sales department of the Four Wheel Drive Auto Company, Clintonville, Wis., has been appointed assistant sales manager. Mr. Samels, who is well known in the automobile world, received his early experience with the Chicago office of the Locomobile Company of America, which had charge of a number of the company branches and territory supervision over twenty-four states.

Later, he acted as special Chicago representative for A. J. Banta, President of the Maxwell Sals Company.

National Lime Association.

At the annual convention to be held at Hotel Astor, New York, June 16, 17 and 18, there are schedules, interesting papers and discussions, and demonstrations on the new electrolytic lime treatment of sewage by F. M. Morerck, chemical engineer, Direct Oxidation Process Company, Philadelphia. The use of lime in construction will also be discussed.

Machinery Handling Exhibit.

The Material Handling Machinery Manufacturers' Association has made arrangements to occupy the entire third floor of the Grand Central Palace, New York, at the New York Electrical Show with an exhibit and demonstration of material handling machinery including small trucks, portable cranes, trailers, and the like.

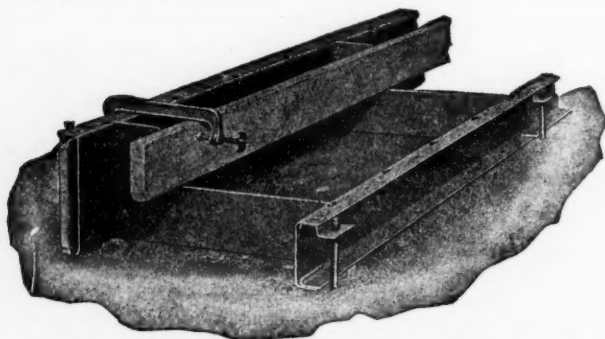
PROBLEMS THAT CITIES ARE STUDYING WITH EXPERTS.

Topeka, Kansas, has contracted with five different engineering concerns to make independent investigations and submit recommendations, estimates of the cost, etc., for providing an adequate city WATER SUPPLY. It is expected that very extensive improvements will be made after the bonds are voted upon and sold.

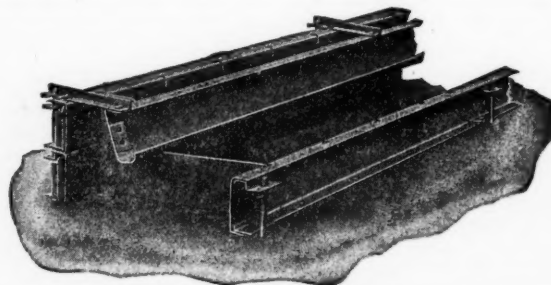
Morris Knowles, Incorporated, Engineers, Pittsburgh, are at present engaged in making comprehensive CITY PLANNING STUDIES at Marion, Indiana. Included in the work outlined are the preparation of topographic and base maps, housing studies, study of streets and utilities, park systems and zoning. This organization is also at present retained to make investigations and report on MUNICIPAL ELECTRIC LIGHTING PLANTS at Richmond, Indiana and Jefferson, Ohio, and has just recently completed similar studies for the City of Ashtabula, Ohio. At Carrollton, Ohio, investigations of the present WATER SUPPLY and plant are under way and a report will be submitted in the near future. Among other activities, the Cleveland office of Morris Knowles Incorporated is now engaged in making a SANITARY SURVEY of the Cuyahoga Conservancy District, while the office at Windsor, Ontario, Canada, along with other work, is engaged in water works design and supervision of construction for Canadian towns near Detroit.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations.



UNIVERSAL FORM WITH WOOD FACE FOR COMBINED CURB AND GUTTER.



UNIVERSAL FORM FOR COMBINED CONCRETE CURB AND GUTTER.

BLAW FORMS FOR ROADS AND STREETS.

Steel Blaw forms made in a large variety of standard and special types easily modified, combined and adapted for variations in requirements, have been designed to meet all kinds of street and pavement construction especially in the large majority of cases where heavy plant is used in the grading, surfacing and concreting.

The forms are made duplicate and interchangeable with simple details following closely, a very direct and efficient type of construction and so well devised that the method of application and operation is obvious to any one having even a vague idea of their use and application. They require few repairs, and are easily stored, transported and handled.

They are constructed of sheet metal, bent to exact standards, and with very few fabricated joints so that they are equally light, stiff and durable and can be applied to light or heavy work and to even the most intricate designs of curb, curb and gutter, integral curb and pavement, bituminous surface road and other similar structures.

There are three types of Blaw forms for road and street construc-

tion, namely, Universal type forms, and two types of special road forms. Universal forms are adapted to general construction which may include all kinds of curb, gutter and sidewalk work, type "B" special road forms are for use with hand, roller, or belt finished concrete roads and type "C" are for roads where mechanical plant is used for subgrading or finishing.

All sections of forms are provided with the sliding slip joint which is integral with each, locks adjacent sections securely together, and has sufficient flexibility to provide for change of grade and alignment. It permits any section of the form to be removed from the assembled forms without disturbing adjacent sections, and thus enables openings to be made in the forms at any point to permit the entrance and exit of trucks.

Universal forms are made of various heights and of standard lengths of 10 feet with provision for expansion joints every 12 inches. They are securely held in position by steel stakes driven through flange angles and, in special road forms, are locked in position by tapered wedges arranged so that they clear the construction plant that moves on the forms as on rails. The bottom flanges are wide enough to afford bearing for heavy plant on comparatively soft soil and the curb and gutter forms are so designed that they can be assembled in tiers to provide for different lengths of structure.

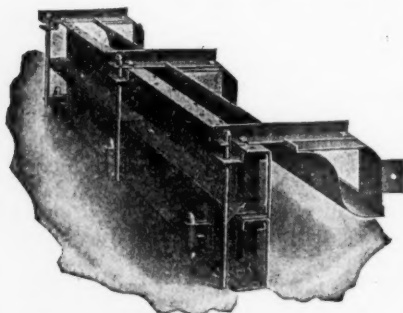
VARIOUS MATERIALS.

Trade commissioner H. W. Adams, of Paris, has transmitted copies of the French standard specifications on various materials, gotten out by the Commission Permanente de Standardization of the Ministry of Commerce. These pamphlets may

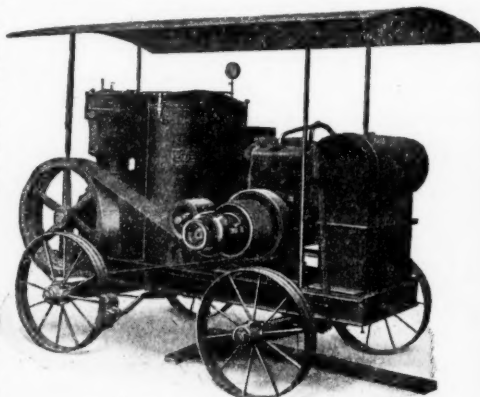
be examined at the Bureau of Foreign and Domestic Commerce by referring to file No. 21289.

CONTRACTORS' PORTABLE COMPRESSOR.

A light, strong, vertical air compressor and receiver mounted on a steel truck and especially designed for general contractors' purposes has been placed on the market by the Chicago Pneumatic Tool Company. The gasoline engine has four water jacketed cylinders and a positive system of circulation with cooling water forced through the jackets and an efficient radiator by centrifugal circulating pumps, one of which is driven by a belt from the compressor shaft and the other is geared from the engine shaft. They are supplemented by a fan installed immediately behind the radiator, and require but little water. All compressors are tested by a shop run previous to shipment and are guaranteed for one year against defective materials or workmanship. With the engine operating at 1,000 r. p. m. and the compressor at 400 r. p. m. the capacity is 140 cubic feet per minute.



FORM FOR BUILDING CURB AND PAVEMENT INTEGRAL.



AIR COMPRESSOR WITH CAPACITY OF 140 C. F. PER MINUTE.